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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/682,014	10/09/2003	Wade Thomas Cathey JR.	405834	7759

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EXAMINER	
AMARI, ALESSANDRO V	

ART UNIT	PAPER NUMBER
2872	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	**Application No.** 10/682,014	**Applicant(s)** CATHEY ET AL.
	Examiner Alessandro V. Amari	**Art Unit** 2872

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-32 and 34-36* is/are rejected.

7)☒ Claim(s) *33* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 October 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the optical arrangement and the one or more specially designed optical elements as recited in claim 1 and the variants of the specially designed optical elements recited in claims 11-17 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

2. Claims 1-20 and 33 is objected to because of the following informalities:

Regarding claim 1, it is unclear whether the "one or more specially designed optical components" are part of "the optical arrangement" or a separate element. Claims 2-20 inherit the same issue.

Regarding claim 33, the term "PSF" should be spelled out. Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-7, 9-15, 17-30, 32 and 34-36 are rejected under 35 U.S.C. 102(b) as being anticipated by Hammond, Jr. US 6,097,856.

In regard to claims 1, 21 and 22, Hammond teaches (see Figures 2, 3) an imaging system for imaging an object to an image plane or a method for reducing depth of field of an image of an object, comprising an optical arrangement (20-1, 20-2) for forming an intermediate image of the object at an intermediate image plane with a first value of axial resolution or with a first depth of field as described in column 6, lines 43-67 and column 7, lines 1-67 and column 8, lines 1-16; a digital processor (40-1, 40-2) configured to process the intermediate image to form a final image of the given object at the image plane; and one or more specially designed optical elements (24-1, 22-1, 24-2, 26-2) configured to cooperate with the optical arrangement and the digital processor to define a second value of axial resolution that is greater than the first value or define a second depth of filed that is less than the first depth of field as described in column 5, lines 65-67, column 6, lines 1-42. Although the prior art does not specifically disclose, the claimed axial resolution improvement or reduction in depth of field, this is seen as an inherent teaching of the system since the system reduces the amount of out of focus error over a range of distances.

Regarding claims 2 and 23, Hammond teaches that the specially designed optical elements are disposed between the object and the intermediate image plane as shown in Figures 2 and 3 and as described in column 6, lines 43-64.

Regarding claims 3 and 24, Hammond teaches that the optical arrangement forms an exit pupil and wherein the specially designed optical elements are disposed adjacent to the exit pupil as described in column 3, lines 35-39.

Regarding claims 4 and 25, Hammond teaches that the optical arrangement forms an exit pupil and an image of the exit pupil, and wherein the specially designed optical elements are disposed at the image of the exit pupil as described in column 3, lines 35-39.

Regarding claims 5 and 26, Hammond teaches that the optical arrangement forms an aperture stop and wherein specially designed optical elements are disposed adjacent to the aperture stop as described in column 12, lines 25-37.

Regarding claims 6 and 27, Hammond teaches that the optical arrangement forms an aperture stop and an image of said aperture stop at a predetermined location, and wherein the specially designed optical elements are disposed at the predetermined location as described in column 12, lines 25-37.

Regarding claims 7, 9, 30 and 32, Hammond teaches that the specially designed optical elements comprise a random phase plate or phase grating as described in column 6, lines 43-64.

Regarding claim 10, Hammond teaches the specially designed optical elements are configured to form a series of sinusoidal functions modifying a phase function of electromagnetic energy forming the intermediate image as described in column 6, lines 43-64.

Regarding claims 11, 12, 13, 14, 15, 17, 28, 29, Hammond teaches that the specially designed optical elements comprise at least one refractive element or at least one diffractive element or a single optical element or wherein the single optical element comprises one or both of refractive and diffractive qualities or comprise one or more optical surfaces or at least one diffractive surface as shown in Figures 3A and 3B and as described in column 6, lines 43-67 and column 7, lines 1-67 and column 8, lines 1-.

Regarding claims 18 and 34, Hammond teaches that the intermediate image having a plurality of frequency components with amplitude characteristics, the specially designed optical elements attenuating the amplitude characteristics of certain of the frequency components, the digital processor being configured to amplify the amplitude characteristics of the certain frequency components as described in column 7, lines 50-67, column 8, lines 1-39, column 12, lines 14-67, and column 13, lines 1-63.

Regarding claim 19 and 35, Hammond teaches that the intermediate image forming a plurality of frequency components with phase characteristics, the specially designed optical elements perturbing phase characteristics of certain of the frequency components, the digital processor being configured to correct perturbed phase characteristics of the certain frequency components as described in column 7, lines 50-67, column 8, lines 1-39, column 12, lines 14-67, and column 13, lines 1-63.

Regarding claim 20, Hammond teaches that the optical arrangement forming a first depth of field, the specially designed optical elements and the digital processor cooperating to form a second depth of field that is less than the first depth of field as described in column 5, lines 65-67, column 6, lines 1-42. Although the prior art does not specifically disclose, the claimed reduction in depth of field, this is seen as an inherent teaching of the system since the system reduces the amount of out of focus error over a range of distances.

In regard to claim 36, Hammond teaches (see Figures 2, 3) an imaging system for imaging an object to an image plane, comprising an optical arrangement (20-1, 20-2) configured to form an intermediate image of the object at an intermediate plane, the optical arrangement including one or more optical elements (22-1, 22-2), and a specially designed optical element (24-1, 26-1, 24-2, 26-2); and a digital processing arrangement (40-1, 40-2) configured to process the intermediate image to form (a) an in focus image of a first axial portion of the object and (b) an out of focus image of a second axial portion of the object as described in column 6, lines 43-67 and column 7, lines 1-67 and column 8, lines 1-16.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 8 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hammond Jr. US 6,097,856.

Regarding claims 8 and 31, Hammond teaches the invention as set forth above but does not teach that the specially designed optical elements comprise a pseudo-random phase plate. It is well known in the diffractive art to utilize pseudo-random phase plates. It would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize a pseudo-random phase plate in the imaging system of Hammond in order to provide for improved uniformity of the output beam.

7. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hammond Jr. US 6,097,856.

Regarding claim 16, Hammond teaches the invention as set forth above but does not teach that the specially designed optical elements comprise at least one reflective surface. It is well known to use reflective surfaces in the imaging art. It would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize a reflective surface in the imaging system of Hammond to provide for a different optical configuration to make the system more compact.

Allowable Subject Matter

8. Claim 33 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

9. Claim 33 is allowable over the prior art for at least the reason that the prior art fails to teach or reasonably suggest, “the phase grating exhibits an in-focus PSF and an out-of-focus PSF, and wherein the phase grating is designed such that an angle between the in-focus PSF and the out-of-focus PSF is maximized in Hilbert space” as set forth in the claimed combination.

The prior art of record, Hammond Jr. teaches a method for reducing depth of field of an image of an object, comprising the steps of forming an intermediate image of the object at an intermediate plane by one or more optical elements defining a first depth of field; perturbing a phase function of electromagnetic energy forming the intermediate image by a specially designed optical element such as a phase grating; and digitally processing the intermediate image to form a final image such that the one or more optical elements and the specially designed optical element define a second depth of field that is less than the first depth of field. However, the prior art does not teach that the phase grating exhibits an in-focus PSF and an out-of-focus PSF, and wherein the phase grating is designed such that an angle between the in-focus PSF and the out-of-focus PSF is maximized in Hilbert space and there is no motivation or teaching to modify this difference as derived.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Cathey, Jr. et al US 5,748,371 teaches a system to correct the effects of focus producing aberrations.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alessandro V. Amari whose telephone number is (571) 272-2306. The examiner can normally be reached on Monday-Friday 8:00 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew Dunn can be reached on (571) 272-2312. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ava
16 February 2005

MARK A. ROBINSON
PRIMARY EXAMINER